

Graham's Law Questions

1. Compare the diffusion rate of ammonia to sulfur dioxide.
2. An unknown gas composed of homonuclear diatomic molecules effuses at a rate only 0.355 times that of oxygen gas at the same temperature. What is the identity of the unknown gas?
3. Hydrogen has two naturally occurring isotopes, ^1H and ^2H . Chlorine also has two naturally occurring isotopes, ^{35}Cl and ^{37}Cl . Thus, hydrogen chloride gas consists of four distinct types of molecules: $^1\text{H}^{35}\text{Cl}$, $^1\text{H}^{37}\text{Cl}$, $^2\text{H}^{35}\text{Cl}$, and $^2\text{H}^{37}\text{Cl}$. Place these four molecules in order of increasing rate of effusion.
4. Arsenic(III) sulfide sublimes readily, even below its melting point of 320°C . The molecules of the vapor are found to effuse through a tiny hole at 0.28 times the rate of effusion of Ar atoms under the same temperature and pressure conditions. What is the molecular formula of arsenic(III) sulfide in the gas phase?

Non-Ideal Gas Behavior Questions

5. Calculate the pressure that Cl_2 will exert at 40.0°C if 1.00 mol occupies 28.0 L, assuming that **(a)** Cl_2 obeys the ideal gas law; **(b)** Cl_2 obeys the van der Waals equation. (Values for the van der Waals constants are on page 210 in Zumdahl.)
6. Large amounts of nitrogen gas are used in the manufacture of ammonia, principally used in fertilizers. Suppose 80.00 kg of $\text{N}_2(\text{g})$ is stored in a 1000.0 L metal cylinder at 300.0°C . **(a)** Calculate the pressure of the gas assuming ideal-gas behavior. **(b)** Calculate the pressure assuming real gas behavior. **(c)** Under the conditions of this problem, which correction dominates, the one for finite volume of gas molecules or the one for attractive interactions?